

REMARKS

This amendment is responsive to the Office Action issued on November 29, 2002. Re-examination and re-consideration of claims 2-3 are respectfully requested.

THE OFFICE ACTION

The cancellation of independent claim 1 and the amendment of claims 2-4 was acknowledged.

Claim 2 has been rejected for failing to have sufficient antecedent basis for the limitation of "the rotator unit."

Claim 4 has been rejected under U.S.C. §102, second paragraph for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Examiner was unclear about the limitation "and another pair of the S pole and the N pole in which the width of the N pole are alternately arranged." The Examiner interprets the limitation as "and another pair of the S pole and the N pole in which the width of the S pole is set larger than the width of the N pole are alternately arranged." The Examiner further asserted that all limitations of claim 4 were described in claim 3.

Claim 2 has been further rejected under U.S.C. §103(a) as being unpatentable over Saji, et al. (Saji).

Claims 3 and 4 have been rejected under U.S.C. §103(a) as being unpatentable over Saji in view of Sakamoto.

THE CLAIMS DISTINGUISH OVER THE REFERENCES OF RECORD

With reference to the Examiner's rejection based on the holding of *In re Aller*, 105 USPQ 233, it is respectfully submitted that the Examiner has failed to present a prima facie case of obviousness. The Examiner bases his obviousness rejection on the statement that "where general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art." However, there is no range or value of the electrical angle taught in Saji, et al. Thus, a comparison of electrical angle between the claimed invention and the prior art cannot be objectively evaluated. As a result, the difference between the claimed invention and the prior art cannot be concluded to be minor or involving only routine skill in the art. *In re Geiger*, 2 USPQ2d 1276, 1279 (Fed. Cir. 1987).

Saji, et al. arguably does not establish a range for a constant electrical angle, thereby establishing the general conditions of a claim. Therefore, Saji, et al. does not establish nor reasonably suggest that the electrical angle be between 15° and 50°, nor does it establish that the electrical angle be constant.

As described above, the Examiner states the general principle described in *Aller* as follows: "where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art". The Examiner specifically argues that, although Saji, et al. fails to show a stepping motor wherein a magnetic pole width consisting of the south pole and the adjacent north pole together

are such that each pair are different from each other pair by a constant electrical angle ranging from 15° to 50°, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to build a rotor for the stepping motor including the constant electrical angle. As noted, the Examiner does not refer to any teaching in Saji, et al. of ranges of angles. Nor does the Examiner show motivation in Saji, et al. to adopt the range recited in claim 2.

The holding in *In re Aller* does provide for exceptions to the general principle stated by the Examiner. Specifically, modifications or changes may impart patentability to a process if the ranges claimed produce new and unexpected results which are different in kind and not merely in degree from results of prior art. Such ranges are termed critical ranges. The specification, on page 9 from lines 13-20, shows that when the shifted amount (electrical angle) ranges from 15° to 50°, the wow and flutter (W/F (percent)) is 3.0% or less and both the characteristics of the back electromotive force shown in FIGURE 6 follow closely the smooth sine wave.

But, if the shifted amount is larger than 50° or smaller than 15°, the characteristics deviate from the sine wave, as shown in FIGURE 7. Additionally, the specification does not describe the range as merely preferred. Therefore, the applicants contend that this range represents a critical range and produces a result which is different in kind. In support of this argument the Examiner can note that in FIGURE 6 the graph of the voltage characteristic shown as R is different in kind from the voltage characteristic depicted in Q. As shown in FIGURE 6, the voltage

characteristic R of the back electromotive force for the conventional PM type stepping motor has sharp rising and falling edges and draws a recess around each peak of the curve. In contrast, the voltage characteristic Q of the back electromotive force for the PM type stepping motor according to the invention has a smooth sine wave. The applicants, therefore, submit to the Examiner that these resulting diagrams are different in kind.

Additionally, a particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. *In re Antonie*, 195 USPQ 6 (CCPA 1977). Saji, et al. does not recognize reduction in cogging as a function of the constant electrical angle. As detailed above, "...in the PM type stepping motor according to the invention, the voltage characteristic Q of the back electromotive force can form a smooth sine wave for the following reason. As the width of the N pole in a pair is set to be smaller than the width of the S pole, the magnetic flux passing the N pole is eased at the rising and falling edges, and because the voltage characteristic Q of the back electromotive force corresponds to the torque characteristic, a smooth torque characteristic can be obtained, so that reduction in cogging can be easily achieved" (line 21, page 9 through line 4, page 10). Thus, the parameter optimized in the present application was not even recognized in Saji, et al. to be a result-effective variable. It is therefore respectfully submitted that **claim 2** distinguishes patentably and unobviously over the Saji, et al.

patent, as well as the remaining references of record.

Applicants will now address the Examiner's citation of Sakamoto in the rejection of **claim 3**. It is true that Sakamoto discloses a brushless motor wherein one pair of the S pole and the N pole of the rotor are such that the width of the S pole is set to be smaller than the width of the N pole and another pair of the S pole and the N pole are such that the width of the S pole is set to be larger than the width of the N pole and these pairs are alternately arranged. However, the purpose of changing the width of the poles and arranging those poles is substantially different between the Sakamoto reference and the instant application.

In particular, as described in column 1, lines 37 to 43 of Sakamoto, the brushless motor is of a closed loop type in which the rotational position of a rotor is detected by the Hall-effect device 4 and the pair of coils 1_{A1} and 1_{A2} for producing phase A and the pair of coils 1_{B1} and 1_{B2} for producing phase B are switched in order that either the coils 1_{A1} and 1_{A2} or the coils 1_{B1} and 1_{B2} are supplied with electric current. In other words, excitation timing is taken by detecting the pole position.

In such a type of motor as in Sakamoto, it is the purpose of changing the width α and β of the poles on the rotor to shift the excitation timing so that the sharp drop in torque produced by the main magnetic poles 2N and 2S at every switching point in a torque curve a is compensated by an increase in torque produced by the supplemental magnetic poles 3N and 3S on curve b (column 1, lines 53-68).

Contrary to the above-described motor of the Sakamoto

reference, the stepping motor of the instant application is of an open loop type in which the coils of the motor are excited at a constant period from outside, independently of the pole position of the rotor and, therefore, there is no change in excitation timing. Thus, no switching point can exist, and no compensation as described above is necessary.

Furthermore, the purpose of changing the width of the magnetic poles on the rotor is, as described on page 2, lines 5-9 and lines 19-25 of the present application, to solve a problem where cogging is caused by fluctuation of magnetic flux. This fluctuation can be caused by magnetization of magnetic poles with equal magnetization widths. A further objective of the present application is to provide a stepping motor of low vibration realized by reducing cogging with a simple structure while maintaining desirable motor performances such as torque.

To summarize, if attention is given only to the magnetization pattern of magnetic poles on the rotor, there appears to be a similarity between Sakamoto and the invention as claimed in dependent **claim 3**. However, since there is a significant difference in type, structure and excitation method of the cited Sakamoto motor and the stepping motor of the present application, and also different purposes for changing the width of the poles, the applicants submit that **claim 3** is patentably distinct over the combination of Saji, et al. and Sakamoto.


CONCLUSION

For the reasons stated above, it is respectfully submitted that claims 2-3 distinguish patentably and unobviously

over the references of record. Re-examination and early allowance of claims 2-3 are earnestly solicited.

Respectfully submitted,

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